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**CLAIMS:**

1. A method for depositing gold at one or more sites on a substrate, comprising:

(a) binding, depositing or forming nucleation centers at said one or more sites; said nucleation centers comprising at least one member of a recognition group consisting of two or more molecules or complexes which bind to each other, the other member including or forming said one or more sites, coupled to at least one nucleation center being one or more of the group consisting of metal particle, cluster containing metal atoms, a metal-containing complex and molecules.

(b) Contacting under appropriate conditions said one or more sites with a treatment composition comprising a soluble gold-providing agent, being a gold-containing molecule or complex and comprising a reagent, the composition being kinetically stable such that gold is essentially not deposited on the substrate unless a nucleation center is present on the substrate and in the presence of a nucleation center at said one or more sites, gold atoms are released from said gold-providing agent and deposited onto said nucleation center to form gold metal deposits at said one or more sites.

2. A method according to Claim 1, wherein the one member of the recognition group is coupled to at least one nucleation center, being one or more of the group consisting of: cluster containing metal atoms and metal containing complexes and metals.

3. A method according to Claim 1, wherein the one member of the recognition group is coupled to at least one nucleation center being one or more of the group consisting of gold particle, cluster containing gold atoms and gold-containing complexes and molecules.

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4. A method according to Claim 1, wherein the one member of the recognition group is coupled to at least one nucleation center being one or more of the group consisting of cluster containing gold atoms and gold-containing complexes and molecules.

5. A method according to Claim 1, wherein said {} recognition group is a member of the group consisting of: an antigen and an antibody or an antibody derivative with an antigen-binding domain; sugar and a lectin; a receptor and a ligand; a nucleotide sequence and a complementary nucleotide sequence; a nucleotide sequence and its binding protein or other specific binding agent; biotin and avidin or streptavidin; cellulose or chitin and cellulose binding domain.

10. A method according to any one of Claims 1 to 5, wherein said treatment composition is an aqueous solution.

15. A method according to Claim 6, wherein said gold-providing agent is  $\text{Au}^+(\text{SCN})_2$ .

16. A method according to Claim 7, wherein said reagent is hydroquinone or naphthohydroquinone.

17. A method for assaying presence of a specific substance at sites on a substrate, comprising:

20. (a) providing conditions allowing formation of nucleation centers on sites containing said substance;

21. (b) contacting said substrate with a treatment composition comprising a soluble gold providing agent, being a gold-containing molecule or complex and comprising a reagent, the composition being kinetically stable such that upon such exposure gold metal is essentially not deposited on the substrate unless a nucleation center is present thereon, and in the presence of a nucleation center at said sites, gold atoms are released from said gold-providing agent and deposited onto said nucleation center to form gold metal deposits at said sites; and

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(c) detecting metallic gold deposits on said substrate, a gold deposit at a site on the substrate indicating presence of said substance at said site.

10. A method according to Claim 9, wherein step (a) comprises:

5 (a1) providing nucleation center-forming agents which comprise each at least one moiety, having specific binding affinity to said substance, bound to at least one nucleation center being one or more of the group consisting of metal particle, cluster containing metal atoms and a metal-containing complex; and

10 (a2) contacting said substrate with said agents.

11. A method according to Claim 10, wherein said moiety is included in one member of a recognition couple consisting of two molecules or complexes which specifically bind to one another, the other member included in or constituting said substance.

15 12. A method according to Claim 11, wherein said recognition couple is a member of the group consisting of an antigen and an antibody or an antibody derivative with an antigen-binding domain; sugar and a lectin; a receptor and a ligand; a nucleotide sequence and a complementary nucleotide sequence; a nucleotide sequence and its binding protein or other specific binding agent; biotin and avidin or streptavidin; cellulose or chitin and cellulose binding domain; said moiety being one of the recognition couple and said substance being or including the other.

20 13. A method according to any one of Claims 9-12, for assaying the presence of one or more target oligonucleotides with a specific target sequence in a sample, comprising:

25 (a) providing a substrate carrying one or more probe oligonucleotides each with a probing sequence complementary to one of said target sequences;

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(b) contacting said substrate with the sample and providing conditions allowing formation of nucleation centers where a target oligonucleotide hybridizes to a probe oligonucleotide;

(c) contacting said substrate with a treatment composition comprising a gold-providing agent, being a gold-containing molecule or complex and comprising a reagent, the composition being kinetically stable such that upon such exposure gold metal is essentially not deposited on the substrate unless a nucleation center is present thereon, and in the presence of a nucleation center at said sites, gold atoms are released from said gold-providing agent and deposited onto said nucleation center to form gold metal deposits at said sites; and

(d) detecting metallic gold deposits on said substrate, a gold deposit at a site on the substrate indicating the presence of said substance at said site.

14. A method according to Claim 13, wherein said step (b) comprises:

(b1) treating said sample to bind a label to oligonucleotides in the sample;

(b2) contacting said sample with said substrate; and

(b3) contacting said substrate with a nucleation center-containing agent, capable of specific binding to said label.

15. A method according to Claim 13, wherein said step (b) comprises:

(b1) treating said sample so as to bind nucleation centers to oligonucleotides present therein; and

(b2) contacting said samples with said substrate.

16. A method according to any one of Claims 9 to 15, wherein said nucleation center is a gold particle a cluster containing gold atoms, or a gold-containing complex or molecules.

17. A method according to any one of Claims 9 to 16, wherein said treatment composition is an aqueous solution.

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18. A method according to Claim 17, wherein said gold-providing agent is  $\text{Au}(\text{SCN})_2$  and said reagent is a quinone.

19. A method according to any one of Claims 9 to 18, wherein said substrate is a specimen for viewing in an imaging or visualization technique.

5 20. A method according to Claim 19, wherein the detection technique is based on light.

21. A method according to Claim 19, wherein the {} detection technique is based on light absorbance and/or light transmission and/or light reflectance and/or light scattering.

10 22. A method according to Claim 19, wherein said detection is made by techniques selected from transmission electron microscopy, scanning electron microscopy, atomic force microscopy.

23. A method according to Claim 19, for preparing the specimen for viewing in a microscope, comprising the following steps:

15 (a) providing conditions permitting formation of nucleation centers at selective sites of the specimen; and

(b) contacting said specimen with a treatment composition comprising a soluble gold-providing agent, being a gold-containing molecule or complex and comprising a reagent, the composition being kinetically stable such that gold is

20 essentially not deposited on the specimen a nucleation center is present thereon, whereby gold atoms from said gold-providing agent are released and deposited onto said specimen at selective sites.

24. A method according to any one of Claims 9 to 18, wherein said substrate contains separated fractions of a sample.

25 25. A method according to Claim 23 for identifying locations of a specific separation product on the substrate, comprising the steps of:

(a) providing conditions permitting formation of nucleation centers at sites on said substrate comprising said specific separation product;

(b) contacting said substrate to a treatment composition comprising a

30 soluble gold-providing agent, being a gold-containing molecule or complex and

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comprising a reagent, the composition being kinetically stable such that gold is deposited on the substrate essentially only where a nucleation center is present thereon, whereby upon such contact, gold atoms from said gold-providing agent are released and deposited onto said nucleation center; and

5 (b) detecting presence of gold on said substrate, such gold signifying presence of said specific separation product on the substrate at a site where the gold is detected.

.25. A method for assaying presence of an analyte in a sample comprising:

10 (a) providing a substrate carrying capturing agents which bind said analyte;

(b) contacting said substrate with said sample, whereby said analyte binds to said capturing agents;

15 (c) providing conditions permitting formation of nucleation centers on sites of said substrate comprising said analyte;

(d) contacting said substrate with a treatment composition comprising a soluble gold-containing molecule or complex and a reagent, the composition being kinetically stable such that gold is deposited on the substrate essentially only at sites thereof containing the nucleation centers; and

20 (e) detecting metallic gold deposits on said substrate, indicative of the presence of said analyte in said sample.

.26. A method according to Claim 25, wherein step (c) comprises:

25 (c1) providing nucleation center-forming agents which comprise each at least one moiety, having specific binding affinity to said analyte, coupled to at least one nucleation center being one or more of the group consisting of metal particle, cluster of metal atoms and a metal-containing complex; and

(c2) contacting said substrate with said agents.

.27. A method according to Claim 26, wherein said analyte is one of a binding couple consisting of an antigen and an antibody or an antibody derivative with an antigen-binding domain; sugar and a lectin; a receptor and a ligand; a

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nucleotide sequence and a complementary nucleotide sequence; a nucleotide sequence and its binding protein or other specific binding agent; biotin and avidin or streptavidin; cellulose or chitin and cellulose binding domain; and said at least one moiety is the other of said binding couple.

5 28. A method according to Claim 25 wherein step (b) comprises:

10 (b1) contacting said sample with nucleation centers, the nucleation centers being one or more of the group consisting of metal particles, cluster of metal atoms and metal-containing complexes or molecules, and providing conditions for coupling of said nucleation centers to the analyte if present in the sample, thus obtaining a modified sample containing modified analytes; and

(b2) contacting said substrate with said modified analytes bound to said nucleation centers.

29. A method according to Claim 28, wherein said analyte is one of a binding couple consisting of an antigen and an antibody or an antibody derivative with an antigen-binding domain; sugar and a lectin; a receptor and a ligand; a nucleotide sequence and a complementary nucleotide sequence; a nucleotide sequence and its binding protein or other specific binding agent; biotin and avidin or streptavidin; cellulose or chitin and cellulose binding domain; and said capturing agent is the other of said binding couple.

30. A method according to any one of Claims 25 to 29, wherein said capturing agents are carried on the substrate between electrodes such that gold deposited onto said nucleation centers in step (d) establishes an electric contact between the electrodes; and

25 detection of the gold deposits in step (e) is performed by measuring  
current-potential relationship between the electrodes.

30. A method according to any one of Claims 25 to 30, wherein said at least one metal particle, cluster of metal atoms or a metal-containing complex is a gold particle or cluster containing gold atoms.

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32. A method according to any one of Claims 25 to 31, wherein said treatment composition is an aqueous solution.

33. A method according to Claim 32, wherein said gold-providing agent is  $\text{Au}^1(\text{SCN})_2$ . 34 A method according to Claim 32, wherein said reagent is a hydroquinone.

35. A kit for use in the method according to any one of Claims 1 to 34.

36. A kit according to Claim 35, comprising a treatment composition which comprises a soluble gold-providing agent, being a gold-containing molecule or complex and comprises a reagent, the composition being kinetically stable such that upon contact with a substrate gold is deposited on a substrate essentially only at sites of the substrate containing nucleation centers.

37. A kit according to Claim 35 or 36, further comprising nucleation center-forming agents, for forming nucleation centers at one or more sites on the substrate, said agents comprise each at least one {} member of a recognition group having a specific binding affinity to a substance present at said one or more sites coupled to at least one nucleation center moiety, being one or more of the group consisting of metal particle, cluster of metal atoms and a metal containing complex or molecule.

38. A kit for use in a method according to any one of Claims 25 to 34, for assaying an analyte in a sample, comprising:

- a substrate carrying capturing agents which bind said analyte;
- agents for forming nucleation centers at portions of the substrate on which said analyte becomes immobilized;
- a treatment composition comprising a soluble gold-containing molecule or complex and a reagent, the composition being kinetically stable such that gold is deposited on the substrate essentially only at sites thereof containing the nucleation centers.

39. A kit according to Claim 38, wherein said agent for forming nucleation centers comprises a nucleation center and substances needed in order to couple said nucleation center to said analyte.

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40. A kit according to Claim 38, further comprising nucleation center-forming agents which comprise each at least one moiety, having specific binding affinity to said analyte, coupled to at least one nucleation center moiety being one or more of the group consisting of metal particle, cluster of metal atoms and a metal containing complex.

41. A kit according to any one of Claims 38 to 40, wherein said substrate comprises two or more electrodes, and said capturing agents are carried within gaps between the electrodes.

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